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SUMMARY

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NON-TRADITIONAL BUILDING MATERIALS IN THE TROPICS

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Non-Traditional Building Materials in the Tropics D.14

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Summary

1. Traditional methods of construction depend upon the building materials available locally and in rural tropical areas great use is still made of indigenous materials such as bamboo, thatch and earth. In urban tropical areas the higher constructional standards required necessitate using materials of greater durability. Some plastics, emulsion paint, pitch-fibre pipes and aluminium are considered - all introduced to urban tropical areas within the last ten years. Through the study of the weathering agencies that cause change, and the physical and chemical properties of such non-traditional materials, the United Kingdom Building Research Station can now offer considerable guidance as to their likely behaviour.

2. These weathering agencies are solar radiation, moisture, atmospheric pollution and biological attack. They are not unique to the Tropics; it is variation in their intensity which is mainly responsible for any differences in the behaviour of materials exposed in temperate and tropical regions.

3. Materials exposed to direct solar radiation commonly reach temperatures far greater than shade air temperature. High temperatures increase the rate of evaporation of water from concrete, plasters and renderings and of solvents from paints; plasticisers in plastics are lost more rapidly, thermoplastic materials flow more readily and the permeability of plastics films increases. Temperature change can result in stresses leading to distortion or rupture. Short period changes through rain or through cloud passing across the sun are particularly responsible for the breakdown of surfaces. Sunlight can cause the embrittlement, crazing and discolouration of plastics, paint and rubber.

4. High total and intensity rainfall can erode soft materials and are conducive to the corrosion of metals; hail can damage brittle roofing materials. Condensation - particularly in crevices - can also corrode metals and may cause building boards to rot, soften or swell. Wide fluctuations of relative humidity can cause materials based on wood or wood-fibre to distort or split.

5. In warm, wet regions insects abound and considerable damage is caused by termites to wood-based materials; plastics, rubber cables and paint films may also be attacked. In the Tropics industrial pollution is at present slight but attack by sea-salts is severe near surf beaches; in dry areas sandstorms can cause damage through abrasion.

6. Glass-fibre reinforced polyester sheets and domes are used to admit daylight into a building. Tropical exposure results in discolouration and a decrease in light transmission. Polyethylene pipe is used for cold-water services. It does not corrode and is tough; allowance must be made for its high coefficient of thermal expansion. Polyethylene sheet is used as a vapour barrier and as a curing membrane for concrete. Black opaque sheet has a greater resistance to solar radiation than clear sheet. Termites are known to attack both low-density polyethylene pipe and sheet. Phenol-formaldehyde resin is used in the manufacture of tough, rigid and durable corrugated roofing sheets which discolour somewhat upon exposure but are neither attacked by termites nor support mould growth. Expanded phenol-formaldehyde and expanded polystyrene are available for thermal insulation. The latter has a low water absorption but its permeability is appreciable; its resistance to solar radiation is not high. Protected from sun and rain it is durable and appears not to be attacked by termites.

7. Emulsion paints based on polyvinyl acetate produce clean pastel tints which dry quickly. Best results are obtained on porous surfaces such as plaster; slightly damp surfaces can be painted, adhesion is good and flaking seldom occurs. They are resistant, though not immune, to mould growth and lime bloom is common where the emulsion paint is applied to materials containing cement or lime.

8. Pitch-fibre pipes are tough, light in weight and easily joined together without the aid of jointing compounds. They are resistant to soil sulphates, sewage, termites and fungal attack but not to continuous hot water or pitch solvents. They behave successfully underground but could deteriorate and distort if exposed to the sun for long periods.

9. Aluminium alloy is used for roofing, wall cladding and for the framework of "curtain-wall" buildings. In direct contact with many other materials in the presence of moisture electrolytic corrosion can occur; so may it, too, if the building design is such that crevices are formed where water can lie. Such aggressive conditions should be prevented. Glare can be troublesome with new sheets in bright sun but embossed or etched sheets do not cause this annoyance. Special sheets having concealed fixings are available for the low-pitch roof.

10. The materials discussed have been made and developed by industry in temperate regions. Their likely behaviour in less developed tropical areas can now be assessed through the application of science by such organizations as the United Kingdom Building Research Station.

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